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Abstract

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PI Title: ASSOCIATE PROFESSOR

Project Title: PREFRONTAL AMYGDALA INTERACTIONS IN FEAR CONDITIONING

Abstract: DESCRIPTION (Adapted from applicant's abstract): Research into the neurobiology of emotion has advanced in recent years with studies of fear conditioning a neutral stimulus (the conditioned stimulus, CS) becomes associated with an aversive event (the unconditioned stimulus, US) so that subsequent exposure to the CS evokes physiological and behavioral fear responses. Repeated presentation of the CS without the US leads to a diminution of fear responses, a process known as extinction. Failure to extinguish fear responses may form the basis of anxiety disorders such as phobias and post traumatic stress disorder. While the neural circuitry for the acquisition of fear conditioning is becoming well understood, the circuitry of extinction is relatively unknown. The amygdala is crucial for fear conditioning. Cortical inputs to the amygdala, while not required for fear conditioning may modulate fear behavior. Recent data suggest that the medial prefrontal cortex (mPFC) and the basolateral nucleus of the amygdala (BLA), which are interconnected, may form part of the neural circuitry of extinction. Three experiments will test this central hypothesis. 1. Rats with lesions of the mPFC will be trained in conditioned suppression of bar pressing, followed by extinction and reinstatement (hypothesis: rats without mPFC will acquire, but not extinguish fear responses). 2. Tetrodes will be used to record from multiple mPFC neurons in behaving rats undergoing acquisition and extinction of fear conditioning (hypothesis: mPFC neurons will show extinction induced changes in tone responses and cell-cell correlations that did not occur during acquisition, suggesting a role of mPFC in learning new CS-US associations during extinction). 3. mPFC will be stimulated in anesthetized rats while recording from BL neurons (hypothesis: mPFC causes feed forward inhibition of BLA). And, 4. Tetrodes will be used to record from BLA neurons during fear conditioning, in animals with and without an intact mPFC (hypothesis: BLA cells from control animals will show rapid extinction of conditioned tone responses, while BLA cells from lesions animals will extinguish more slowly). This research will advance our understanding of fear processing in the brain. In particular, it will begin to tell us what circuits are important for extinction, and how extinguished stimuli are represented differently from non-extinguished stimuli in small groups of neurons. Ultimately, it will lead to more effective treatments for anxiety disorders, as our understanding of the neural mechanisms of fear increases.

Thesaurus Terms:

amygdala, behavioral extinction, conditioning, fear, prefrontal lobe /cortex
association learning, brain electrical activity, brain mapping
behavioral /social science research tag, experimental brain lesion, histology, laboratory rat,
light microscopy, microelectrode

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